

## **Bartering used stone tools: when did communicative ability and conceptual structure begin to interact?**

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*Abstract. Wilkins and Wakefield (W&W) are clearly correct to separate linguistic capacity from communicative ability, if only because other animal species have one without the other. But I question the abruptness of the demarcation W&W make between a period when hominids evolved enriched conceptual representation for other reasons entirely, and a subsequent later stage when language use became an adaptation.*

I welcome the new term “re-appropriation”. In support of this concept I offer the observation that a pervasive aspect of modern language use provides an absolutely unequivocal example — literacy. As W&W note, literacy is too recent historically for most human communities to have any evolutionary component in an adaptationist sense. But it depends on specialized brain areas in much the same way as speech (Petersen 1993; Howard et al. 1992). Reading and writing are therefore complex skills which make use of neural mechanisms adapted for other purposes – presumably including those which allow for detailed foveal visual information, such as that required in inspecting stone tools, to be associated with suitably complex heard or spoken referents. “Cultural re-appropriation” (in which, as with literacy, new uses are found for already-present mechanisms) is ubiquitous in human civilization (there is evidence for selective activation of specialized brain areas, in musical and mathematical skilled performance, and in chess: Sergent et al. 1992)

Tool construction and use certainly, social cognition almost certainly, and speech presumably, are primary candidates for areas of human competence in which biological evolution involving adaptations rather than re-appropriation was significant. W&W argue that the human “language” areas evolved first without any connection with communication. I would agree that animal cognition is more relevant than animal communication to the precursors of the distinctive representational properties required for human language (Note 33). But it does not make much biological sense to completely divorce language from communication, and it does not seem necessary for W&W to do this (and indeed W&W are happy with pressures for linguistic communication at later stages of evolution.). It would be natural to say that the vocal-auditory channel was re-appropriated from non-linguistic to linguistic communication, and this would in no way preclude the central proposition that some cognitive evolution had to take place in advance of this.

I take issue with the claim that a communication based account cannot explain the localization of language cortex. Why is Broca’s area adjacent to the primary motor area for the control of the vocal organs rather than to that for the feet? Classical accounts of localization, including those of “non-localizers” such as Hughlings Jackson (1883/1932) and Head (1926) make the obvious points about topographical/evolutionary associations, without denying that Broca’s area is involved hierarchical and grammatical functions rather than just simple motor control (Walker 1987). This does not mean that W&W are wrong to propose

that genetic mechanisms for the adaptation of tool using led to a changes in secondary motor cortex which were sufficiently general to apply to the speech organs as well as the upper limbs, or more abstractly, that tool use requirements led to the cortex as a whole becoming capable of subserving more sophisticated motor programming and conceptual representation. (One may comment in relation to the point about the accuracy needed in throwing that the use of the feet for directing missiles was unlikely to be of any value to hominid predators, and yet the outcomes of human evolution allow for soccer's World Cup as well as baseball's World Series.) Similarly W&W may be right that abstract amodal perceptual representation in the POT predated speech perception, but the prominence of the temporal lobe in most descriptions of Wernicke's area could nevertheless reflect the use of the auditory channel in communication.

There is something to be said for the reverse of W&W's theory — the possibility that sophisticated use of the vocal-auditory channel for social cognition (Dunbar 1993) led to more elaborate functions for secondary cortex which were then re-appropriated to serve improvements in tool use. As they say “primates are noisy animals” and the zoologist from Mars might conclude in the first instance that human language involves mainly making different kinds of noises. The linguist in an inter-planetary team would no doubt soon correct this misconception and there ought to be agreement that an important part of language evolution lies in vocalization becoming more volitional and referential, and less limbic and emotional (and as far as the zoologist is concerned, less instinctive, because there is a more variable relationship between emotional states and vocal output: although human language may remain in crucial ways an instinct the transitions from *H. habilis* to *H. sapiens sapiens* will have been marked by more variability and openness to novelty and invention, rather than less.) But this was surely likely to have been a gradual rather than an abrupt process. Modern human vocalization is not devoid of emotional content – we still have in crying, screaming, and to some extent in single word swearing, limbic remnants, which may survive the loss of grammatical functions in aphasia.

Even though the referential properties of language lie completely outside the domain of animal communication, there remains a degree of overlap in social functions: human language still serves for individual, group, and gender recognition, greeting, affiliation, threat and assertion (Walker 1994). Darwin's recognition some evolution of hominid cognition must have occurred “before even the most imperfect form of speech could have come into use” (Darwin 1871/1901, p. 133) is consistent with the present proposals, but Darwin has to be categorised as a supporter of the role of social communication in language, since he located its origin in techniques of courtship: precursors of language could have been used in impressing potential sexual partners and rivals before more advanced syntax became part of a cognitive “arms race” or a device to enhance success in bartering used stone tools. Tool use is discussed by W&W in terms of solitary perceptual-motor skills, which are undoubtedly important, but there may equally have been implications for cultural learning, which Tomasello et al. (1993) have suggested can be tied to developmental changes in social cognition which could have had phylogenetic counterparts (Donald 1993), and the dimensions of social exchange in tool using communities could also have been part of a matrix in which social and referential functions of vocalization intertwined.

The case for “referential specificity” and “metaphorical mapping” evolving independently of communication is well-made, within the severe limits of the available evidence. The full development of these capacities may interact with language use, both ontogenetically and phylogenetically. As W&W have pushed the initial cognitive pre-

adaptations for language so far back in the hominid lineage their position is consistent with prior forms of communicative language use having driven 2 million years' worth of brain evolution.

## References

- Darwin, C. (1871/1901) *The Descent of Man and Selection in Relation to Sex*. London: John Murray.
- Donald, M. (1993) Précis of *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*. *Behavioural and Brain Sciences*, 16:737-791.
- Dunbar, R.I.M. (1993) Coevolution of neocortical size, group size and language in humans. *Behavioural and Brain Sciences*, 16:681-735.
- Head, H. (1926) *Aphasia and Kindred Disorders of Speech*. London: Cambridge University Press.
- Howard, D. Patterson, K., Wise, R., Douglas Brown, W., Friston, K., Weiller, C. and Frackowiak, R. (1992) The cortical localization of the lexicons: Positron Emission Tomography evidence. *Brain*, 115, 1769-1782
- Jackson, J.H. (1883/1932) *Selected Writings. Volume Two. Evolution and Dissolution of the Nervous System*. J. Taylor, ed. London: Hodder and Stoughton
- Petersen, S.E. (1993) The processing of single words studied with positron emission tomography. *Annual Review of Neuroscience*, 16:509-530
- Sergent, J., Zuck, E., Terriah, S. and MacDonald, B. (1992) Distributed neural network underlying musical sight-reading and keyboard performance. *Science*, 257, 106-109.
- Tomasello, M. Kruger, A.C. and Ratner, H.H. (1993) Cultural learning. *Behavioural and Brain Sciences*, 16, 495-552.
- Walker, S.F. (1987) The evolution and dissolution of language. In Ellis, A. (ed.), *Progress in the Psychology of Language. Volume 3*. Lawrence Erlbaum: London, 5-48.
- Walker, S.F. (1994) 'Animal Communication' in Asher, R.E. and Simpson, J.M.Y. (eds) *The Encyclopedia of Language and Linguistics, Vol. 4*, Oxford, Pergamon, pp. 128-136.